HETG/LETG — Status
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HETG/LETG Activities Summary

Performance April 2020 — October 2020

**HETG/ACIS-S** 2200 ks
- 80 observations on 18 targets (51 GO, 8 GTO, 5 Cal, 4 TOO, 12 DDT)

**LETG** 450 ks, 8 targets
- 17 LETG/HRC-S observations (105 ks; 0 GO, 1 GTO, 6 Cal, 0 TOO, 9 DDT, 1 CoolCatTarg)
- 10 LETG/ACIS-S observations (240 ks; 10 Cal)
- 4 LETG/HRC-I observations (105 ks; 1 Cal, 2 GTO, 1 TOO)

*Grating performance is nominal.*

[http://tgcat.mit.edu](http://tgcat.mit.edu)

*TGCat* has 2201 extractions for 521 objects (+102/+20 since last report)
Total volume: 486 GB
Downloads: 617 packages, 62 GB
Maintenance: port to modern infrastructure (PHP, MySQL), new server continuing.
HETG GTO Science Program

**Cycle 20:**
- **NS:** Terzan 5 X-2 0/200 ks TOO (10%); Neutron Star Equation of State
- **LIGO:** GW2019nnnn 0/300 ks TOO (10%); Gravitational wave transient
- **Stars:** SZ 96 246 ks Young, low mass stellar accretion
- **XRB:** 4U 1626-67 48 ks Neutron star accretion (monitoring)
- **SNR:** Cas A 92 ks Decadal visit — 20 yrs on, dynamics
- **AGN:** Mrk 335 0/280 ks TOO Narrow Lined Seyfert, w/ NuSTAR, NICER; warm absorbers
- **SNR:** Cas A 92 ks Decadal visit — 20 yrs on, dynamics

**Cycle 21:**
- **Stars:** Brey 84 231 ks Massive stars, stellar winds
- **XRB:** IGR J16318-4848 0/250 ks Fe diagnostics of neutron star accretion; with NuStar
- **XRB:** 4U 1636-53 0/140 ks ISM survey, Si edge absorption, scattering.
- **LIGO:** GW2020nnnn 0/300 ks Gravitational wave transient (un-triggered)
- **NS:** Terzan 5 X-2 0/200 ks TOO (10%); Neutron Star Equation of State (un-triggered)
- **NS:** 4U 1820-30 0/200 ks TOO; Neutron star gravitational redshift, radius (un-triggered)
HETG GTO Science Program (continued)

Cycle 22:

★ AGN: Mrk 335  
   82 ks TOO Narrow-Lined Seyfert, w/ NuSTAR, NICER; warm absorbers
★ AGN: NGC 1365  
   0/300 ks Seyfert galaxy; outflows, ionization state, variability
★ Stars: ρ Oph A  
   0/200 ks Massive star winds
★ XRB: 4U 1626-67  
   0/60 ks Ultra-compact binary; monitor disk emission lines.
★ XRB: GX 17+2  
   0/100 ks ISM survey; Silicon gas-to-dust ratios
★ XRB: GX 3+1  
   0/100 ks ISM survey, ionized Silicon variability
★ BH: SS 433  
   0/225 ks Relativistic jets in a black-hole, massive star binary; monitor flow.
★ NS: 4U 1820-30  
   0/250 ks TOO; Neutron star gravitational redshift, radius

HETG Postdoc status/activities:
New hires:
Daniele Rogantini (SRON) - started 16 Oct
Peter Kosec (U.Cambridge) - starts 1 Jan 2021

The rest of our postdocs on whom we depend…

Pragati Pradhan  Jun Yang  Steven Silverberg  Alan Garner  Erin Kara

“New” faculty (since 7/2019) working with the group…

Daniele  Peter
LETG GTO Science Program

Cycle 19:
★ NS: (Predehl/MPE) RX J2143.0+0654 173 ks Cyclotron Absorption Line in an Isolated Neutron Star (LETG/HRC-S)
★ ISM: (Kaastra/SRON) 4U 1608-522 25 ks ISM dust, Mg and Si K-edge absorption (HETG/ACIS-S)
★ Gal: (Kaastra/SRON) 1E 2216/1E 2215 147 ks Shocks in Galaxy Cluster Collisions (ACIS-I)

Cycle 20:
★ NS: (Predehl/MPE) RX J1856.6-3754 166 ks Isolated neutron star, calibration (with eRosita) (LETG/HRC-S)
★ Gal: (Kaastra/SRON) NGC 5548 168 ks AGN outflows, absorption, ionization, obscuration (HETG/ACIS-S)

Cycle 21:
★ AGN: (Kaastra/SRON) Mrk 279 0/175 ks AGN outflows, ionization, absorption (LETG/HRC-S)
★ SN,SNR: (Predehl/MPE) DEM S5 0/171 ks Pulsar wind nebula, morphology, dynamics (ACIS-S)
★ Sol.Sys: (Predehl/MPE) Mars 0/75 ks Solar wind - atmosphere interaction (LETG/HRC-S)

Cycle 22:
★ Stars (Predehl/MPE) RX J0859.1+0537 0/60 ks Accretion onto white dwarfs (LETG/HRC-S)
★ Stars (Predehl/MPE) RX J1002.2-1925 0/48 ks Accretion onto white dwarfs (LETG/HRC-S)
★ AGN (Predehl/MPE) HSC J092120.56+000722.9 0/20 ks Confirmation of faint z=6.56 eROSITA Quasar (ACIS-S)
★ AGN (Predehl/MPE) 2MASX J09325962+0405062 0/50 ks Confirmation of eROSITA Compton-thick Seyfert (ACIS-S)
★ AGN (Kaastra/SRON) MR 2251-178 0/175 ks Galaxy outflows, absorption line density diagnostics (LETG/HRC-S)
HETG: Calibration Update

Effects of a Warm ACIS Focal Plane on HETGS Spectroscopy

Possible effects investigated:
• Change in detector Quantum Efficiency
• Gain changes in centroid of order selection
• RMF width change affects flux collected

Methods:
Took several datasets with observations over a range in focal-plane temperatures ($\theta^1$ Ori C, Capella, 4U 1626), looked at fluxes (QE), order-sorting centroids (gain), and order-sorting widths (RMF).

A very brief guide to HETG spectral calibration:

CCD Energy distribution … and 1st order flattened.

Do the centroid, width, or area change with temperature?

<— dispersion direction —>
Do the centroid, width, or area change with temperature?

- Effect of higher $T$ on Quantum Efficiency looks negligible.
- $<1\%$ effect on order-sorting window due to shift in energy centroid (gain)
- $<1\%$ effect due to wider energy distribution width (RMF)

Caveats:
- Small RMF effects need more data
- Some inconsistencies between datasets

**Overall impression:** OK to use HETG at warm ACIS temperatures (which is an aid to Chandra operations)

For details, see: <https://space.mit.edu/cxc/docs/WarmACISeffectsOnOSIP_20200611.pdf>
HETG GTO/GO Science: Let’s look at ALL* the papers…

*which have “HETG” in the abstract and are refereed.

(Or, having fun with the “new” ADS.)

Authors

Subjects

ngc absorber warm 3c radio
observation calibration 1x1 xmmnewton cygnus
cataclysmic variable nonmagnetic ratio source
corona ophiuchi rs abundances wave
1987a sn evolution observation remnant
black hole transient neutron
X-ray Spectra and Light Curves of Cooling Novae and a Nova-Like
Sun, Bangzheng; Orlo, Marina; Dobroska, Andrej and 3 more

#Citations, #Reads, Journals

HETG; Chandra Quarterly #50, 27 Oct 2020
“We find that a handful of knots are moving at speeds approaching $\sim 104$ km/s, with expansion indices approaching $\eta \sim 1$, indicating nearly a free expansion. Based on our radial velocity measurement of such a fast-moving ejecta knot, we estimate the distance to Kepler. ... a relatively long distance of $d > 5$ kpc is favored. Our estimated distance range generally supports an energetic SN Ia for Kepler.”